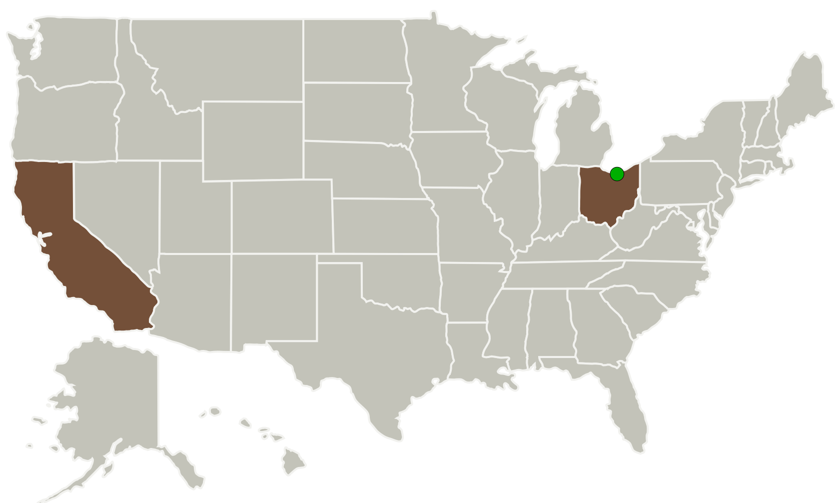
Micropump for MON-25/MMH Propulsion and Attitude Control, Phase II

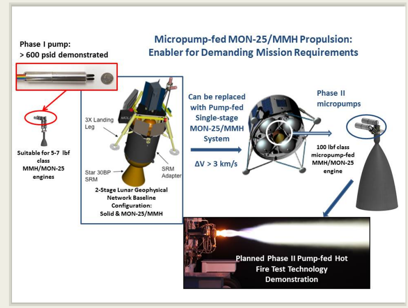
Completed Technology Project (2016 - 2018)

Project Introduction

Flight Works is proposing to expand its work in micro-gear-pumps for hypergolic and ?green? propellants in order to develop and demonstrate a micropump for MON-25 and mono methyl hydrazine (MMH) bipropellant thrusters. MON-25, with 25% of nitric oxide (NO) and 75% nitrogen tetroxide (NTO, N2O4), allows lowering the oxidizer freezing point to -55 C, which is a close match to that of the fuel, MMH (which is around -51 C). While toxic, this propellant combination is hypergolic and allows operations over a wide range of temperatures, particularly in extremely cold environments as those envisioned for many future missions. For NASA deep space and Moon/Mars missions, such as lunar lander and Mars ascent vehicles, the introduction of a micropump in the propulsion system provides significant performance benefits. For missions with high delta-Vs, the system wet mass is greatly reduced, or at fixed total wet mass, scientific payload mass increases. For example, in the case of a lunar lander (delta-V > 3,000 m/s), a two-stage configuration can be replaced by a pump-fed single-stage system of the same mass while the pressure-fed would have to be larger. Flight Works is proposing to develop and characterize micropumps suitable for 5 lbf and 100 lbf MMH/MON-25 thrusters. These will be used to perform pump-fed MMH/MON-25 hot-fire test demonstrations of the technology under representative environmental conditions in order to reach a TRL 6 by the end of Phase II.

Primary U.S. Work Locations and Key Partners





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Completed Technology Project (2016 - 2018)

Organizations Performing Work	Role	Type	Location
Flight Works, Inc.	Lead Organization	Industry	Irvine, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

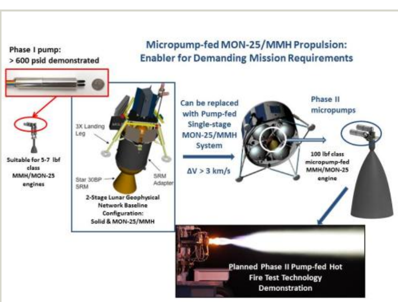
Project Transitions

April 2016: Project Start

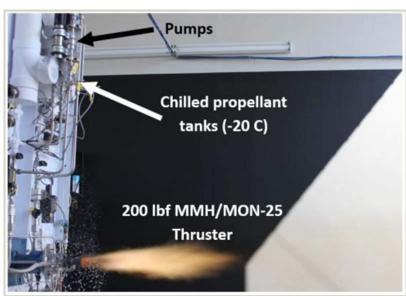
October 2018: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/139612)*

Images



Briefing Chart Image
Micropump for MON-25/MMH Propulsion and Attitude Control, Phase II
(https://techport.nasa.gov/image/136105)



Final Summary Chart Image
Micropump for MON-25/MMH Propulsion and Attitude Control, Phase II
(https://techport.nasa.gov/image/131454)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Flight Works, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

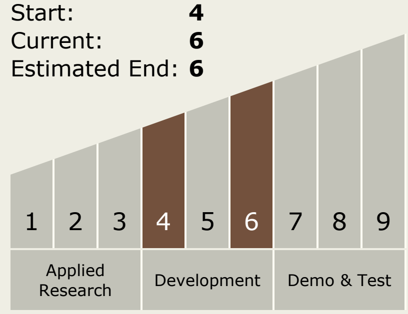
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Nadim R Eid

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX01 Propulsion Systems
  └ TX01.1 Chemical Space Propulsion
    └ TX01.1.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System